

Claims

What is claimed is:

1. A method of determining a patient's cardiac condition by using a CPAP apparatus for treating sleep disordered breathing, comprising the steps of:
sensing the patient's cardiogenic pressure or flow oscillations; and
using the sensed cardiogenic oscillations to determine the patient's cardiac condition.
2. The method of claim 1 wherein the occurrence of a central apnea event is identified by determining the occurrence of cardiogenic oscillations during a period of no airflow and wherein the patient's cardiac condition is determined based upon the known association of central apneas and cardiac morbidity.
3. The method of claim 1 wherein cardiogenic oscillations in only the middle to later portion of exhalation are used to determine the patient's cardiac condition.
4. The method of claim 3 wherein the middle to later portion of exhalation is determined by tracking the recent averaged lapsed time of prior breathing cycles and using such time in conjunction with the detection of the start of a breathing cycle.
5. The method of claim 1 further comprising the step of sending a signal to the patient, care provider or physician, or recording an arrhythmia event for later observation, upon determining the existence of an arrhythmia event.
6. The method of claim 1 further comprising the step of determining cardiac timing from the time between cardiogenic oscillations.
7. The method of claim 1 further comprising the step of adjusting the patient's stroke volume by examining the amplitude of the cardiogenic oscillations and in accordance therewith adjusting the CPAP treatment pressure.

8. The method of claim 1 further comprising the step of analyzing the cardiogenic oscillations to determine the patient's pulse transit time.
9. The method of claim 1 further comprising the step of analyzing the cardiogenic oscillations against ECG waveforms to determine changes in the patient's pre-ejection period.
10. The method of claim 1 further comprising the step of assisting cardiac function in accordance with the determined cardiac condition by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
11. The method of claim 1 further comprising the step of assisting cardiac function by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion. Or arterial (aortic) tone?
12. The method of claim 1 further comprising the step of using cardiogenic oscillation information for managing triggering of a bi-level CPAP apparatus.
13. A method of determining a patient's cardiac condition and providing cardiac treatment by using a CPAP apparatus for treating sleep disordered breathing, comprising the steps of:
 - sensing the patient's cardiogenic pressure or flow oscillations; and
 - using the sensed cardiogenic oscillations to determine the patient's cardiac condition and adjust the pressure delivered by the CPAP apparatus to treat the patient's cardiac condition.
14. The method of claim 13 wherein the occurrence of a central apnea event is identified by determining the occurrence of cardiogenic oscillations during a period of no airflow and wherein the patient's cardiac condition is determined based upon the known association of central apneas and cardiac morbidity.

15. The method of claim 13 wherein cardiogenic oscillations in only the middle to later portion of exhalation are used to determine the patient's cardiac condition.
16. The method of claim 15 wherein the middle to later portion of exhalation is determined by tracking the recent averaged lapsed time of prior breathing cycles and using such time in conjunction with the detection of the start of a breathing cycle.
17. The method of claim 13 further comprising the step of sending a signal to the patient, care provider or physician, or recording an arrhythmia event for later observation, upon determining the existence of an arrhythmia event.
18. The method of claim 13 further comprising the step of determining cardiac timing from the time between cardiogenic oscillations.
19. The method of claim 13 further comprising the step of adjusting the patient's stroke volume by examining the amplitude of the cardiogenic oscillations and in accordance therewith adjusting the CPAP treatment pressure.
20. The method of claim 13 further comprising the step of analyzing the cardiogenic oscillations to determine the patient's pulse transit time.
21. The method of claim 13 further comprising the step of analyzing the cardiogenic oscillations against ECG waveforms to determine changes in the patient's pre-ejection period.
22. The method of claim 13 further comprising the step of assisting cardiac function in accordance with the determined cardiac condition by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
23. The method of claim 13 further comprising the step of assisting cardiac function by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.

24. The method of claim 13 further comprising the step of using cardiogenic oscillation information for managing triggering of a bi-level CPAP apparatus.
25. A CPAP apparatus which, in addition to providing CPAP therapy, determines a patient's cardiac condition, the apparatus comprising a controller and a sensor for detecting pressure in the patient's CPAP mask, wherein the controller:
senses the patient's cardiogenic pressure oscillations; and
uses the sensed cardiogenic oscillations to determine the patient's cardiac condition.
26. The apparatus of claim 25 wherein the controller:
identifies a central apnea event by determining the occurrence of cardiogenic oscillations during a period of no airflow; and
determines the patient's cardiac condition based upon the known association of central apneas and cardiac morbidity.
27. The apparatus of claim 25 wherein the controller uses cardiogenic oscillations in only the middle to later portion of exhalation to determine the patient's cardiac condition.
28. The apparatus of claim 27 wherein the controller determines the middle to later portion of exhalation by tracking the recent averaged lapsed time of prior breathing cycles and using such time in conjunction with the detection of the start of a breathing cycle.
29. The apparatus of claim 25 wherein the controller sends a signal to the patient, care provider or physician, or recording an arrhythmia event for later observation, upon determining the existence of an arrhythmia event.
30. The apparatus of claim 25 wherein the controller determines cardiac timing from the time between cardiogenic oscillations.

31. The apparatus of claim 25 wherein the controller adjusts the patient's stroke volume by examining the amplitude of the cardiogenic oscillations and in accordance therewith adjusting the CPAP treatment pressure.
32. The apparatus of claim 25 wherein the controller analyzes the cardiogenic oscillations to determine the patient's pulse transit time.
33. The apparatus of claim 25 wherein the controller analyzes the cardiogenic oscillations against ECG waveforms to determine changes in the patient's pre-ejection period.
34. The apparatus of claim 25 wherein the controller assists cardiac function in accordance with the determined cardiac condition by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
35. The apparatus of claim 25 wherein the controller assists cardiac function by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
36. The apparatus of claim 25 wherein the controller uses cardiogenic oscillation information for managing triggering of the CPAP apparatus.
37. A CPAP apparatus which, in addition to providing CPAP therapy, determines a patient's cardiac condition and provides cardiac treatment, the apparatus comprising a controller and a sensor for detecting pressure in the patient's CPAP mask, wherein the controller:
- senses the patient's cardiogenic pressure oscillations; and
 - uses the sensed cardiogenic oscillations to determine the patient's cardiac condition.
38. The apparatus of claim 37 wherein the controller:

identifies the occurrence of a central apnea event by determining the occurrence of cardiogenic oscillations during a period of no airflow; and

determines the patient's cardiac condition based upon the known association of central apneas and cardiac morbidity.

39. The apparatus of claim 37 wherein the controller uses cardiogenic oscillations in only the middle to later portion of exhalation are used to determine the patient's cardiac condition.

40. The apparatus of claim 39 wherein the controller determines the middle to later portion of exhalation by tracking the recent averaged lapsed time of prior breathing cycles and using such time in conjunction with the detection of the start of a breathing cycle.

41. The apparatus of claim 37 wherein the controller sends a signal to the patient, care provider or physician, or recording an arrhythmia event for later observation, upon determining the existence of an arrhythmia event.

42. The apparatus of claim 37 wherein the controller determines cardiac timing from the time between cardiogenic oscillations.

43. The apparatus of claim 37 wherein the controller adjusts the patient's stroke volume by examining the amplitude of the cardiogenic oscillations and in accordance therewith adjusting the CPAP treatment pressure.

44. The apparatus of claim 37 wherein the controller analyzes the cardiogenic oscillations to determine the patient's pulse transit time.

45. The apparatus of claim 37 wherein the controller analyzes the cardiogenic oscillations against ECG waveforms to determine changes in the patient's pre-ejection period.

46. The apparatus of claim 37 wherein the controller assists cardiac function in accordance with the determined cardiac condition by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
47. The apparatus of claim 37 wherein the controller assists cardiac function by adjusting the CPAP treatment pressure to assist right atria filling, left ventricular ejection, or cardiac perfusion.
48. The apparatus of claim 37 wherein the controller uses cardiogenic oscillation information for managing triggering of a bi-level CPAP apparatus.